Finding, however, that other neighbours had noticed the same thing, and that at Golden Grove, near Roscrea, the workmen had observed that not only the water in the barrels was black, and was even next morning "like ink," but also that there was a decided blackness and scum in the pools on the carriage drive, at some distance from any chimney, I was convinced that the blackness had come from the thunder-cloud.

At so great a distance (about 200 miles) from any large smoke-producing town this was somewhat remarkable.

I was able to procure from one place, from near Eyrecourt, Co. Galway, through the kindness of the Rev. C. Lawrence, of Lisreaghan, Eyrecourt, a sample of the water. It is stated to have been of a dark blue colour, but when it reached my hands it had become pale reddish brown, with a considerable amount of solid matter in suspension.

Dr. W. J. Russell, F.R S., has been good enough to examine the sample, which appears to behave in all respects much as London rain water, except in being free from acid reaction (this may be due to previous impurity in the collecting vessel). The amount of sulphates is represented by 0·074 gramme of H_2SO_4, and of chlorides by 0·066 gramme of HCl, in a litre. The solid matter is devoid of structure or of crystalline form, and appears to be soot. The specimen is, however, the less satisfactory from having been taken from near a house where coal has been burnt.

I understand that the rain was black near Shinrone, King's County, and that a few blackish drops were noticed at Dundrum, near Cashel. From Ballymore Castle, near Eyrecourt, where the sample was obtained, to Golden Grove, the distance is about 23 statute miles, and Shinrone is between them. From Eyrecourt to Dundrum is about 48 miles. Mr. Lawrence tells me that the blackness of the rain was noticed by several of his neighbours, and that a laundress kept the water three weeks in the barrels, and had then to reject it, as it was still too much discoloured.

Possibly it may be worth noting that two days before (April 10) there was an intense blackness like that of a moonless night in London, between 12.30 and 1.30 p.m., but I have at present no evidence to connect it with the phenomenon above described.

Athenæum Club, S.W., June 18. ROSSE.

On the Theory of Hail.

IN last week's NATURE (p. 151) Prof. Robinson gives an account of a hailstone that fell at Liverpool on the 2nd instant, consisting of an opaque nucleus, surrounded by almost clear ice, and this by opaque ice.

Hailstones formed of concentric layers, like the coats of an onion, are by no means uncommon. The number of layers has been known to amount to as many as thirteen (*American Journal of Science*, l., 403); but the statement that such a structure is formed, as Prof. Robinson supposes, "during electric oscillation from cloud to cloud," belongs to a theory that has often been disproved. Nor would it probably have excited much attention, but that it originated with no less a man than Volta, who, seeing how pith balls and other light objects oscillated between two metal plates in opposite electrical states, imagined that the hailstone acquired its successive coatings by oscillating between two clouds in opposite states, until its weight became too great for the electric force to sustain it against the gravitating force.

The two most distinguished writers who have examined this theory, and have shown its futility are Kämtz (*Lehrbuch der Meteorologie*, ii. 525) and Becquerel ("Traité de l'Electricité," iv. 151).

The theory of hail which scientific meteorologists now accept, originated with Prof. Olmsted, of Yale College (I have not the reference at hand to the *American Journal of Science*, but see *Edin. New Phil. Journ.*, ix. 244). This theory has received its finishing touches in the papers of the United States Coasts Survey ("Meteorological Researches for the use of the Coast Pilot," Part ii., p. 85, Washington, 1880). The writer is Mr. William Ferrel.

Limiting our notice to such compound hailstones as the one described by Prof. Robinson, which from their size and velocity are the most destructive, and are produced during a tornado or a violent thunderstorm, the following is in few words the theory of their formation. When the wind gyrates rapidly round an axis, more or less inclined to the earth, the space at and about the axis is rarefied. When air charged with vapour is drawn into this rarefied space, it may be condensed into cloud or rain, but at a greater elevation into snow. Now, supposing the rain formed in the lower region to be drawn up by the ascending current into the snowy region, and so held for a short space, the drops will be frozen, and then if propelled beyond the gyrations it will fall to the ground as a shower of ordinary hail. But if in the descent they are again drawn in by the inflowing current, they will be again carried up into the cold region, and so acquire another coating of snow, or, if wetted in the previous descent, the water will freeze into a coat of transparent ice. In this way the globule may make a number of ascents and descents, and acquire a fresh coating each time.

From the date of Franklin's experiments even to our own day, the formation of hail has been attributed to electricity. Even so good an observer as Peltier ("Météorologie," p. 116), while rejecting Volta's theory, offers an electrical theory of his own, with the complacent remark that "Volta a placé des suppositions où je place des faits;" but De la Rive, in noticing Olmsted's theory, very properly remarks that although electricity always accompanies the formation and fall of hail, these two phenomena are not connected as cause and effect.

Highgate, N., June 20. C. TOMLINSON.

Curious Effects of Lightning on a Tree.

DURING the recent thunderstorms a large elm-tree was struck by lightning in a private park at Dulwich, but the only visible effects were linear interrupted grooves about ¾ inch deep, extending down one side of the tree to the ground, where two or three depressions some 3 inches deep were found. The bark is scooped out as clearly as if done with a gouge, and the intervals are from 1 to 2 feet in length, while the grooves themselves are from 1 to 3 feet in length. The grooves are now filled with mildew, which, I take it, indicates the death of the adjacent bark. I have often seen trees which have been struck by lightning, but none in which the effects have at all resembled those I have described. ALFRED S. GUBB.

Gower Street, W.C.

The Formation of Cumuli.

A VERY perfect illustration of the method of formation of cumuli was noted by the writer recently. A perpendicular column of smoke was seen capped at a vast height by a rounded mass of cumulus cloud having a flattened under surface. The ascending warm current being traceable by the smoke, and the cloud-cap very distinct and persistent, the appearance was very striking, the sky in the vicinity being intensely blue and otherwise cloudless. M. A. VEEDER.

Lyons, N.Y., June 10.

Coral Reefs.

THE business of the surveyor abroad is not with theories. It is to collect facts; to apply the resources under his command to the delineation of the earth's surface; and to examine the bottom of the ocean. When he begins to theorize, he may be suspected with some reason of bias, and of insensibly colouring his reports with preconceived notions of what he expected to find, instead of carefully storing up evidence. He is, however, at liberty to study the writings of our great naturalists, and to him Darwin is, at present, the great authority: not so much the young naturalist of the *Beagle*, as the matured thinker who, after forty years of deep research into various problems of Nature, published that edition of "Coral Reefs" which has been before the world for the last fifteen years.

With your permission, I desire to ask two or three questions of those gentlemen who are unable to reconcile their views with Mr. Darwin's theory of subsidence.

The Fiji Islands present the most complete collection of coral reefs in the world. We have there the fringe reef, the barrier, and the atoll; islands which have a barrier all around them, others where it is sunken on one side; the island, such as Lakemba, where there is a fringe on one side and a barrier on the other; as Thithia, which is surrounded by fringe only. There are extinct craters, such as Fulanga, and islands with exterior rim and depression in the centre, the formation of which is apparently not due to the volcanic action; islets on the edge of atolls like Ngele Levu which are wholly coral, others of coral in the centre of lagoons. In the same locality may be found islands which have a fringe to windward and barrier to leeward, and those which have a fringe to leeward and a barrier to wind-

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ward. One island which is about the size of Jamaica, has a fringe on one side and an extensive barrier on the other. Shells and coral have been found at great heights, and there are many evidences of upheaval. One small island, called Vatu Leile, appears to be raised on one side and depressed on the other; the raised coast is lined with a fringe-reef, the submerged by a barrier.

In the Lau group, there are two fine barrier reefs—those of the Exploring Isles and the Bukatatanoa. Inside the lagoons of these and other reefs, there are an infinity of coral banks with various depths of water over them, many being mushroom-headed.

The prevailing wind throughout the Fiji group is east-south-east. Unquestionably the coral is in most vigorous growth where there is the most violent surf; and no matter what the current, it is in least vigorous growth on the lee or north-west side.

I believe that it is not inconsistent with the theory put forward by Mr. Darwin that, in the same group, some islands should be rising and some falling at the same time; nor that an island should have fallen to a certain level and have then undergone a movement of upheaval. If this be so, there is nothing, as far as one can see, in the Fiji group which disproves subsidence as the origin of barrier reefs. The questions which I desire to ask are these:—

How does Dr. Guppy account for the remarkable similarity in many instances in this group, between the shape of the barrier reef and that of the coast of the island within it? As examples, I would point to the islands of Nairai and Ngau, and to the correspondence in form between the north-east horn of the barrier of the Exploring Isles and the nearest cape of Vanua Mbalavu with its off-lying islets.

In the case of the Bukatatanoa reefs, how does he account for this great rim being all much on the same level, except by the supposition that it commenced its growth on the same contour? or for the cleanly-cut ship channels which occur on the *weather* side of some of the barriers, except by the supposition that the growth was originally checked by the streams from the land?

It is, I believe, universally admitted that there are large areas of elevation—such, for instance, as the New Hebrides—and corresponding areas of depression. What form, does Dr. Guppy suppose, is assumed by the growing coral on the coasts of the descending islands?

Let me draw attention to Kandavu. To the north of this island there is a barrier reef inclosing a chain of islands of volcanic origin, and gradually decreasing height. The most northerly islet, which is a mere rock (now surmounted by a lighthouse), stands in the centre of a circular barrier of great symmetry. The highest part of Kandavu is over the western end, and here there is comparatively little coral. Has not this group every appearance of a range of mountains, the northern half of which is sinking beneath the ocean? There are many strings of islands in Fiji and eleswhere the position and coral surroundings of which seem to be accounted for only by the theory of subsidence.

Mr. Darwin did not visit Fiji; but it is worthy of note that Mr. Dana spent five months there, and enjoyed peculiar advantages of examination, and that he left it convinced of the general truth of Mr. Darwin's theory.

8 Ashburton Road, Southsea. W. USBORNE MOORE.

Hydrophobia.

I THINK it cannot fail to interest some of the readers of NATURE to know what is written "in the Talmud of old—in the legends the Rabbins have told" about this baneful malady. I have therefore translated a fragment preserved in this ancient work, which, read through the mist of ages and wrapped in the garb of expressions and ideas of a long-ago past, may be of value to the antiquarian, and perhaps not wholly uninteresting to the man of science. A. D.

June 11.

"It is not permissible to give to a person bitten by a mad dog from the lobe of the mad dog's liver, but Rabbi Matya, the son of Hheresh, considers it permissible"[1] ("Mishna," "Tractate Yoma," p. 83).

"He who is bitten by a mad dog, &c." The Rabannan have learnt that there are five indications of rabies, viz. open mouth, dripping saliva, elongation of ears, tail resting on buttocks, and wandering along the sides of the streets. There are some who add barking without sound. How does this come about? Rav says that witches have practised their sorceries upon them, and Samuel says an evil spirit has rested upon them.

What deduction may be made from this difference of opinion? That the mad dog should be killed by means of a weapon hurled from a distance, for in accordance with the view held by Samuel we learn that the dog, when killed, should be despatched from a distance. He who has come into contact with a mad dog by the animal brushing against him is in danger, and he who has been bitten by a mad dog is in peril of his life.

"He who has come into contact, &c." What precaution should he take? He should divest himself of his robes and *run*. Rav Huna, the son of Rav Joshua, came into collision with a mad dog in the street. He threw off his robes and ran, exclaiming, "I illustrate in my own person the Scriptural verse, 'And wisdom is a source of life to those who possess her.'"

"He who is bitten, &c." What precaution should he adopt? Abaya says he should obtain the skin of a male ape and write thereon, "I, so and so, the son of so and so, write upon thee, 'Kanti, Kanti, Kiloroth,'"[1] and those present should respond "Kandi, Kandi, Kiloroth,[1] the Lord, the Lord, the Lord of Hosts, Amen, Amen, Selah." He should then throw off his clothes and bury them in the burial-place for twelve months, after which he should recover them and burn them in a furnace, scattering the ashes across the roads.

During these twelve months, if he should drink water he should do so only through a copper tube, otherwise he might see the reflection of the demon in the water held in the vessel, and suffer dangerous consequences.

It is said of Aba, the son of Matya (he is Aba, the son of Menimah), that his mother made for him a tube of gold ("Gemara," "Tractate Yoma," p. 84).

SIR LYON PLAYFAIR ON UNIVERSITIES.

WE congratulate Sir Lyon Playfair on the admirable speech he delivered last week in the House of Commons on the Scottish University Bill. It was a powerful and luminous exposition of the true functions of Universities, and of the duty of the State with regard to the highest departments of education.

Speaking of the fact that the adaptation of degrees in Scotland had not followed the steady improvement in the education of the people, Sir Lyon Playfair said:—

"Degrees remained much as they were two or three centuries ago. The University was not a technical school, but a school to introduce culture into the professions. Unless that culture were introduced there was no justification for professional schools in the Universities. The *via antiqua* ought to be replaced by a *via moderna*. The Commission of 1878 proposed to open five gateways of knowledge—the gateways of literature and philology, of philosophy, of law and history, of mathematical sciences, and of the natural sciences. Now there was a great difference between the Universities of rich and of poor countries. The Universities of poor countries must rest on the professions. The rich men of Scotland went to Oxford and Cambridge, whereas those who attended the Scotch Universities had to earn their bread by a profession. Unhappily those professions were now being taught without culture; that was, with the exception of theology, the men went through the technical part of their education without taking a degree in arts, though there was a sort of matriculation examination, which did not represent a very high degree of culture. In that way the great medical schools were technical schools which gave length but not breadth of education. One of the greatest reforms to be attained was to carry out the recommendations of 1878 so that, by proper courses in arts, culture might be restored to the professions."

Sir Lyon Playfair spoke as follows about the provision

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[1] The subject of hydrophobia is introduced quite incidentally, the question in dispute between the "Mishna" and R. Matya being whether the patient might eat of the mad dog's liver upon the fast of the Day of Atonement, and the difference of opinion is in consequence of the prescribed remedy being held to be only imaginary on the one side, and a real one on the part of R. Matya.

[1] The meaning of these words is lost.

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